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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,238	03/25/2005	Takashi Arakane	OHTN:023	2552

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EXAMINER	
CROUSE, BRETT ALAN	
ART UNIT	**PAPER NUMBER**
1786	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/529,238	ARAKANE ET AL.
	Examiner	Art Unit
	Brett A. Crouse	1786

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5,8-13 and 18-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,8-13 and 18-28* is/are rejected.

7)☒ Claim(s) *20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☒ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Application Status

1. This office action is in response to the amendment, filed 6 May 2006, which amends claims 1, 2, 4, 5, 8, 13 and 18, cancels claims 14-17 and adds new claims 19-28.

2. Claims 1-5, 8-13 and 18-28 are pending.

Response to Amendment

3. The rejection of Claims 1-5 and 8-18 under 35 U.S.C. 112, second paragraph, is overcome by the amendment, filed 6 May 2010.

4. The rejection of claim 5 under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364, as applied to claims 1, 2, 3, 4, 6, 7, 8, 9, 10, 14, 15, 16, 17, 18 above, and further in view of Adachi et al., Organic Electronics, (2001), Volume 2, Pages 37-43, is withdrawn.

Priority

5. Acknowledgment is made of applicant's claim for foreign priority based on an application filed in Japan on 10/09/02. It is noted, however, that applicant has not filed a certified copy of the Japanese application as required by 35 U.S.C. 119(b).

6. A certified copy of JP 2002-296024 has not been received.

Claim Objections

7. Claim 20 is objected to because of the following informalities:

Claim 20 is objected to because "cathod" is misspelled in line 3 of the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 1-5, 8-13 and 18-25 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the exemplified compounds, does not reasonably provide

enablement for the full scope of the claims. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

Case law holds that applicant's specification must be "commensurately enabling [regarding the scope of the claims]" *Ex Parte Kung*, 17 USPQ2d 1545, 1547 (Bd. Pat. App. Inter. 1990). Otherwise **undue experimentation** would be involved in determining how to practice and use applicant's invention. The test for undue experimentation as to whether or not all compounds within the scope of claims 1-5, 8-13 and 18-25 can be used as claimed and whether claims 1-20 meet the test is stated in *Ex parte Forman*, 230 USPQ 546, 547 (Bd. Pat. App. Inter. 1986) and *In re Wands*, 8 USPQ2d 1400, 1404 (Fed.Cir. 1988). Upon applying this test to claims 1-5, 8-13 and 18-25, it is believed that undue experimentation **would** be required because:

(a) *The quantity of experimentation necessary* is **great** since claims 1-5, 8-13 and 18-25 read on an enormous number of potential compounds, based on experimentally determined properties while the specification discloses a relatively small number of structurally similar compounds which **may** meet the requirements of the physical properties.

(b) There is **no** *direction or guidance presented* for determining in advance which compounds might meet the numerous requirements, short of separately testing every material.

(c) There is an ***absence*** *of working examples* within the scope of the claims. The few inventive examples disclose only closely related inventive compounds for the compound of the light emitting layer.

In light of the above factors, it is seen that undue experimentation would be necessary to make and use the invention of claims 1-5, 8-13 and 18-25.

The materials required by claim 1 are:

a) A light emitting layer of an electroluminescent device comprising a host material having an ionization potential of less 5.9 eV and an electron mobility of 10^{-5} cm^2/Vs or greater, and a phosphorescent dopant. The host material is either a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, each ring or group being optionally substituted, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole.

b) The adjacent layer in contact with the light emitting layer and between the light emitting layer and cathode comprises a material having an energy gap smaller than that of the host material of the light emitting layer.

No guidance is given outside the closely related exemplified compounds as to the effect of the combinations of the large number of possible substituents of the broad general formulae and their effect on the ionization potential and electron mobility of the resulting compounds.

No guidance is given as to the selection of the vast number of materials outside of the general formulae as to the expected properties opposite the instant claims, short of separately testing every material.

The requirements for each of the materials are not defined, except by physical properties. The claimed compounds are materials having a particular oxidation potential and electron mobility or energy gap. The oxidation potential, electron mobility and energy gap can be experimentally determined. The methods and results can vary depending on experimental procedures. As a result, each potential compound (essentially every known, and unknown material comprising a carbazolyl or azacarbazolyl group and a nitrogen containing heterocycle) must be individually tested to determine if the material and subsequently combination of materials meets the qualifications for the layers of the device. As a result, an individual of ordinary skill must resort to trial and error in order to determine which materials are suitable, which is well beyond the level of undue experimentation.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1, 2, 3, 4, 5, 8, 9, 10, 18, 19, 20, 21, 22, 23, 24, 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014 and Ise et al., US 2002/0028329, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et

al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364 and Tang et al., US 4,769,292 and Thoms, US 2004/0247933.

Shirasaki teaches:

As to claims 1, 2, 4, 6, 8, 9, 10, 16, 17, 22, 23, 24:

Column 7, lines 53-58, figure 9, teach an electroluminescent device comprising a hole transport layer, light emitting layer and electron transport layer directly upon the light emitting layer.

Column 11, lines 57-65, figure 19, teach an electroluminescent device comprising a hole transport layer, a light emitting layer which further comprises poly(vinylcarbazole) and a fluorescent dopant, and an electron transport layer directly upon the light emitting layer comprising Alq3.

As to claim 3, 19:

Column 12, lines 5-58, teach a conductive layer which is liable to be oxidized, (a reductive material), between the electron transport layer and cathode.

Shirasaki does not recite:

Shirasaki does not recite a phosphorescent light emitting dopant. Shirasaki also does not recite materials other than PVK as a host material.

Shirasaki does not recite a relationship between the triplet energy level of the hole transport layer material and the triplet energy levels of the phosphorescent dopant of the light emitting layer.

Instant Specification as evidence:

Table 1, page 88, teach the properties of Alq. One of ordinary skill in the art would expect the Alq3 used by Shirasaki to also possess such properties.

Wu et al., as evidence:

Page 2359, column 1, teaches the triplet energy of poly(vinylcarbazole) (PVK) is 2.5 eV.

Bernede et al., Scell-2004 (Abstract) as evidence:

Scell-2004 (Abstract), teaches the HOMO and LUMO of poly(vinylcarbazole) (PVK) are 5.7 eV and 2.2 eV respectively.

Matsushima et al., as evidence:

Matsushima, page 307, column 2, paragraph 1, and figure 6, teaches CBP electron mobility of 10^{-4} cm^2/Vs.

Tang et al., as evidence:

Tang, column 37, lines 65-68, teaches carbazoles are ring bridged variants of aryl amines.

Thoms, as evidence:

Thoms, abstract, teaches carbazoles are bi-polar.

Okada teaches:

Paragraphs [0236]-[0238], example 1, table 1, teaches electroluminescent devices comprising a light emitting layer having the compositions shown in table 1 and an Alq_3 electron transport layer deposited thereupon. Compositions of the light emitting layer include CBP, devices 101 and 102, as host and a phosphorescent light emitting material,

K-1 and K-6, the structures of which are shown in paragraph [0214]. The properties of CBP and Alq are taught in Table 1, page 88, of the instant specification.

Paragraphs [0244]-[0246], example 3, table 3, teach electroluminescent device 301, comprising a hole transport layer, a light emitting layer which further comprises poly(vinylcarbazole) and a phosphorescent dopant K-1, ($Ir(ppy)_3$). The passage also teaches the use of compound 63 as the host material, an imidazopyridine. It is noted that compounds 3 and 53 provide a benzimidazole, and compounds 33 and 43 additionally provide quinoline. The exemplified materials contain numerous compounds comprising a carbazole group bonded via an arylene group to a benzimidazole/imidazopyridine group. Pages 12-13 of the instant specification describe as formula (I) with n=1 a carbazole bonded via an arylene group to a benzimidazole/imidazopyridine group as preferred groups. The instant specification also teaches the ionization potential of 5.6 eV to 5.8 eV. Given this teaching of the preferred groups of the instant specification opposite the structure of compound 63, in the absence of unexpected results the compound would be expected to possess the properties as per the limitations of instant claims 1, 2, 7, 16, 17.

Paragraphs [0054], [0067], formula (A-II), provide examples of the linking group (L) of formula (A-II). Exemplified groups include quinoxaline, pyridine, pyridazine and pyrazine as well as groups comprising pyrimidines and triazines.

Paragraph [0226], teaches the light emitting layer can have a plurality of light emitting layers.

Paragraphs [0217] and [0227]-[0232], teach a hole transport layer, electron transport layer and electron injection layer. The passage additionally teaches the functions of hole blocking and electron blocking are optional.

Paragraph [0004], teaches phosphorescent dopants, such as $Ir(ppy)_3$, provide improved quantum efficiency.

Paragraphs [0206]-[0214], teach preferred phosphorescent compounds. Paragraph [0213], teaches K-1, ($Ir(ppy)_3$), and complexes having the partial structure thereof are preferred.

Ise teaches:

Ise is added to provide additional teachings in support of Okada with respect to the improved efficiency of phosphorescent dopants versus fluorescent dopants opposite applicant's argument that it is not obvious to substitute phosphorescent dopants for fluorescent dopants. Ise additionally provides a teaching of the relationship of the triplet energies between the various material layers.

Paragraphs [0029]-[0033], teach the relationship between the triplet energies of the host material, dopant and material(s) of the adjacent layer(s). Paragraph [0031] teaches the T_1 level of the host material should be high than the T_1 level of the emissive dopant. The paragraph also teaches that efficiency is improved due to exciton confinement if the T_1 level of the material(s) of adjacent layer(s) is selected such that the T_1 level is higher than that of the emissive dopant.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the phosphorescent dopants of Okada in the device of Shirasaki to realize the improved efficiency as suggested by Okada and Ise. It would have been obvious to use the materials of Okada such as compound 63, as the host material in the device of Shirasaki to realize the improved performance when used to replace PVK as taught by Okada. It would have been obvious given the teachings of the material properties of the supporting references to expect the resulting device to possess the interrelationship of properties between the layers as contemplated by applicant. It would have been obvious to select and use materials for the light emitting layer and hole transport layer having the triplet energy relationships as taught by Ise to improve the efficiency of the device of Shirasaki.

12. Claims 11-13 and 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shirasaki et al., US 5,834,894, in view of Okada et al., US 2002/055014 and Ise et al., US 2002/0028329, with further evidence provided by Matsushima et al., Current Applied Physics, (2005), Volume 5, Pages 305-308, and Bernede et al., SCELL-2004 International Conference on Physics, Chemistry and Engineering of Solar Cells, Badajoz, Espagne(13/05/2004), (2005), Volume 87, Number 1-4, Pages 261-270, (Abstract) and Wu et al., Advanced Materials, (2008), Volume 20, Pages 2359-2364 and Tang et al., US 4,769,292 and Thoms, US 2004/0247933, as applied to claims 1, 2, 3, 4, 5, 8, 9, 10, 18, 19, 20, 21, 22, 23, 24, 28 above, and further in view of Okada 6,656,612.

The teachings of Shirasaki / Okada ‘014 as in the rejection above are relied upon.

Shirasaki / Okada ‘014 does not recite:

Shirasaki / Okada ‘014 does not provide an example of an electron transport layer in which an exemplified compound of formula 1 Okada ‘014 is used. Okada ‘014 does teach various heterocyclic derivatives are useful as electron transport materials including Alq as used in Shirasaki.

Okada ‘612 teaches:

Column 2, line 34 through column 6, line 4, formulae (I – XI), teach nitrogen containing heterocyclic compounds useful in electroluminescent devices.

Column 6, lines 33-51, provide examples of condensed rings of the various formulae.

Columns 8 through 12, teach various linking groups including naphthalene and anthracene as required by claim 12.

Column 93, lines 45-63, examples 5 and 6, teach exemplified compounds 21 and 18 in the electron transport layer. The compounds meet the limitations of claims 11, 13, 25 and 27.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the compounds of Okada '612 in the electron transport layer of the device of Shirasaki / Okada '014 with the expectation that the resulting layer of the device of Shirasaki / Okada '612 would exhibit suitable properties and efficient device operation as observed in Okada ‘612.

13. Claim 2, 19, 20, 21, 22, 23, 24 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujino et al., JP 2000-169448, in view of Okada et al., US 2002/055014 and Ise et al., US 2002/0028329, with further evidence provided by Tanaka

et al., Japan Journal of Applied Physics, (2003), Volume 42, Pages 2737-2740 and Tang et al., US 4,769,292 and Thoms, US 2004/0247933.

Fujino teaches:

Abstract and paragraph [0001], teach compounds of formula (I) as charge transfer or light emitting materials. The passage additionally teaches the compounds of formula (I) are useful in electroluminescent devices.

Paragraphs [0032], [0033], [0038], [0039], [0040], compounds (5), (10), (11), (39), (45), (51), teach compounds of formula (I) comprising one or more carbazole groups linked to a pyridine ring via an arylene group. In the absence of unexpected results the compounds are expected to possess properties meeting the host material limitations due to their close similarity in structure to exemplified structure PB-102 of the instant invention.

Paragraphs [0082]-[0083], teach a luminescent dopant added to the light emitting layer.

Paragraphs [0069]-[0072], drawings 1-4, teach electroluminescent device structures.

Paragraph [0118], teaches OXD-7 as the electron transport material in an electroluminescent device example.

Paragraph [0064], teaches an antioxidant in the charge transporting layer.

Tanaka as evidence:

Page 2739, column 1, lines 27-29, teach the triplet energy of OXD-7 is 2.7 eV.

Tang as evidence:

Tang, column 37, lines 65-68, teaches carbazoles are ring bridged variants of aryl amines.

Thoms as evidence:

Thoms, abstract, teaches carbazoles are bi-polar.

Fujino does not teach:

Fujino does not teach the use of a phosphorescent dopant in the light emitting layer.

Okada teaches:

Paragraphs [0236]-[0238], example 1, table 1, teaches electroluminescent devices comprising a light emitting layer having the compositions shown in table 1 and an Alq_3 electron transport layer deposited thereupon. Compositions of the light emitting layer include CBP, devices 101 and 102, as host and a phosphorescent light emitting material, K-1 and K-6, the structures of which are shown in paragraph [0214]. The properties of CBP and Alq are taught in Table 1, page 88, of the instant specification.

Paragraphs [0244]-[0246], example 3, table 3, teach electroluminescent device 301, comprising a hole transport layer, a light emitting layer which further comprises poly(vinylcarbazole) and a phosphorescent dopant K-1, ($Ir(ppy)_3$). The passage also teaches the use of compound 63 as the host material, an imidazopyridine. It is noted that compounds 3 and 53 provide a benzimidazole, and compounds 33 and 43 additionally provide quinoline. The exemplified materials contain numerous compounds comprising a carbazole group bonded via an arylene group to a benzimidazole/imidazopyridine group. Pages 12-13 of the instant specification describe as formula (I) with n=1 a carbazole bonded via an arylene group to a benzimidazole/imidazopyridine group as preferred groups. The instant specification also teaches the ionization potential of 5.6 eV to 5.8 eV. Given this teaching of the preferred groups of the instant specification opposite the structure of compound 63, in the absence of unexpected results the compound would be expected to possess the properties as per the limitations of instant claims 1, 2, 7, 16, 17.

Paragraphs [0054], [0067], formula (A-II), provide examples of the linking group (L) of formula (A-II). Exemplified groups include quinoxaline, pyridine, pyridazine and pyrazine as well as groups comprising pyrimidines and triazines.

Paragraph [0226], teaches the light emitting layer can have a plurality of light emitting layers.

Paragraphs [0217] and [0227]-[0232], teach a hole transport layer, electron transport layer and electron injection layer. The passage additionally teaches the functions of hole blocking and electron blocking are optional.

Paragraph [0004], teaches phosphorescent dopants, such as $Ir(ppy)_3$, provide improved quantum efficiency.

Paragraphs [0206]-[0214], teach preferred phosphorescent compounds. Paragraph [0213], teaches K-1, ($Ir(ppy)_3$), and complexes having the partial structure thereof are preferred.

Paragraphs [0221]-[0222], teach a multilayer cathode structure which can further comprise reductive materials such as those defined in the instant specification on pages 60 and 61.

Ise teaches:

Ise is added to provide additional teachings in support of Okada with respect to the improved efficiency of phosphorescent dopants versus fluorescent dopants opposite applicant's argument that it is not obvious to substitute phosphorescent dopants for fluorescent dopants. Ise additionally provides a teaching of the relationship of the triplet energies between the various material layers.

Paragraphs [0029]-[0033], teach the relationship between the triplet energies of the host material, dopant and material(s) of the adjacent layer(s). Paragraph [0031] teaches the T_1 level of the host material should be high than the T_1 level of the emissive dopant. The paragraph also teaches that efficiency is improved due to exciton confinement if the T_1 level of the material(s) of adjacent layer(s) is selected such that the T_1 level is higher than that of the emissive dopant.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the phosphorescent dopants of Okada in the device of Fujino to realize the improved efficiency as suggested by Okada and Ise. It would have been obvious to use the materials of Okada such as compound 63, as the host material in the device of Fujino to realize the improved performance when used to replace PVK as taught by Okada. It would have been obvious given the teachings of the material properties of the supporting references to expect the resulting device to possess the interrelationship of properties between the layers as contemplated by applicant. It would have been obvious to select and use materials for the light emitting layer and hole transport layer having the triplet energy relationships as taught by Ise to improve the efficiency of the device of Fujino.

14. Claims 25-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujino et al., JP 2000-169448, in view of Okada et al., US 2002/055014 and Ise et al., US 2002/0028329, with further evidence provided by Tanaka et al., Japan Journal of Applied Physics, (2003),

Volume 42, Pages 2737-2740 and Tang et al., US 4,769,292 and Thoms, US 2004/0247933, as applied to claims 2, 19, 20, 21, 22, 23, 24 and 28 above, and further in view of Okada 6,656,612.

The teachings of Fujino/Okada/Ise as in the rejection above are relied upon.

Fujino / Okada ‘014 does not recite:

Fujino / Okada ‘014 does not provide an example of an electron transport layer in which an exemplified compound of formula 1 Okada ‘014 is used.

Okada ‘612 teaches:

<u>Column 2, line 34 through column 6, line 4, formulae (I – XI)</u>, teach nitrogen containing heterocyclic compounds useful in electroluminescent devices.

<u>Column 6, lines 33-51</u>, provide examples of condensed rings of the various formulae.

<u>Columns 8 through 12</u>, teach various linking groups including naphthalene and anthracene as required by claim 12.

<u>Column 93, lines 45-63, examples 5 and 6</u>, teach exemplified compounds 21 and 18 in the electron transport layer. The compounds meet the limitations of claims 11, 13, 25 and 27.

Statement of Obviousness:

It would have been obvious to one of ordinary skill in the art to use the compounds of Okada '612 in the electron transport layer of the device of Shirasaki / Okada '014 with the expectation that the resulting layer of the device of Shirasaki / Okada '612 would exhibit suitable properties and efficient device operation as observed in Okada ‘612.

Response to Arguments

15. Applicant's arguments have been considered but are moot in view of the new ground(s) of rejection.

With regard to the rejection under 35 USC 112, first paragraph, applicant argues that a person of ordinary skill in the art can practice the claimed invention without undue experimentation and would know, given the level of knowledge and skill in this art, how to select the various elements of the organic electroluminescence device based on the claimed structural limitations (e.g., a host material having an ionization potential of 5.9 eV or smaller, an electron injecting layer material having an energy gap smaller than that of the host material, an electron injecting layer material having a triplet energy smaller than that of the host material, and/or the host material being an electron transporting material having an electron mobility of 10^{-5} $cm^2/V.s$ or greater). Applicant additionally argues that the amendment to instant independent claims 1 and 2 to limit the host material to a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom or a compound obtained by bonding a carbazolyl group or azacarbazolyl group to a ring having nitrogen atom via an arylene group, and the ring having nitrogen atom being pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine or benzimidazole places the scope of the claim within the requirements of 35 USC 112, first paragraph. The examiner respectfully disagrees for the reasons below.

The host material as claimed in the instant claims comprises a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine,

pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole. The groups can be directed bonded or linked via an arylene group. The claims do not limit the number of carbazolyl or azacarbazolyl groups, heterocyclic groups, substituents to said groups and additional groups do to the open claim language. The specification does not provide one of ordinary skill in the art guidance as to which compounds within the breadth of the claim would be expected to possess an ionization potential of 5.9 eV or less. As such, undue experimentation on the part of one of ordinary skill would be required to test every compound comprising a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole to determine its ionization potential.

With respect to the rejection over Shirasaki in view of Okada applicant argues the references alone or in combination do not teach or suggest a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole and the properties associated with the host material and their relationship to the materials of adjacent layers. Applicant additionally argues that the ionization potential of the compounds of Okada does not meet the limitations of the claim and that the assertion that the cited compounds possess an ionization potential of 5.9 eV or less is erroneous. The examiner respectfully disagrees for the reasons below.

Okada teaches numerous compounds comprising a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine,

quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole and uses those compounds in the manner as contemplated by applicant.

The resulting prior art compounds possess a close structural similarity to the compounds contemplated by applicant and are used in the same manner as contemplated by applicant.

Similar properties may normally be presumed when compounds are very close in structure. Dillon, 919 F.2d at 693, 696, 16 USPQ2d at 1901, 1904. See also In re Grabiak, 769 F.2d 729, 731, 226 USPQ 870, 871 (Fed. Cir. 1985). Additionally, the prior art need not disclose a newly discovered property in order for there to be a prima facie case of obviousness. In re Dillon, 919 F.2d at 697, 16 USPQ2d at 1904-05 (and cases cited therein). If the claimed invention and the structurally similar prior art species share any useful property, that will generally be sufficient to motivate an artisan of ordinary skill to make the claimed species.

Applicant also argues opposite the rejection over Shirasaki in view of Okada that it is not obvious to replace a fluorescent emissive material with a phosphorescent emissive material.

Okada teaches improved efficiency of electroluminescent devices comprising a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole used in combination with a phosphorescent emissive dopant. In order to further clarify the teachings of the prior art Ise has been added to the rejection to explicitly recite the efficiency of phosphorescent dopants versus fluorescent dopants and the triplet energy relationships between the materials of the device.

Applicant additionally argues that the references due not teach or suggest the exclusion of a hole blocking layer.

The teachings of Okada are broader than the examples. Okada teaches that hole blocking is an optional property of the electron transport layer in paragraph [0230] in the same manner that electron blocking is an optional property of the hole transport layer in paragraph [0227]. Okada further teaches or suggests compounds meeting the limitations of claims 11, 13, 25 and 27. Shirasaki additionally teaches Alq as an electron transport material and Okada metal complexes of quinoline.

With respect to the rejection over Fujino in view of Okada applicant argues that it would not be obvious to replace a fluorescent material with a phosphorescent material.

Okada teaches improved efficiency of electroluminescent devices comprising a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole used in combination with a phosphorescent emissive dopant. In order to further clarify the teachings of the prior art Ise has been added to the rejection to explicitly recite the efficiency of phosphorescent dopants versus fluorescent dopants and the triplet energy relationships between the materials of the device.

With respect to the rejection over Fujino in view of Okada applicant argues the references alone or in combination do not teach or suggest a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole and the properties associated with the host material and their relationship to the materials of adjacent layers. Applicant additionally argues that the ionization potential of the compounds of Okada does not meet the limitations of

the claim and that the assertion that the cited compounds possess an ionization potential of 5.9 eV or less. The examiner respectfully disagrees for the reasons below.

Okada teaches numerous compounds comprising a carbazolyl group or azacarbazolyl group and a heterocyclic group selected from pyridine, quinoline, pyrazine, pyrimidine, quinoxaline, triazine, imidazole, imidazopyridine, pyridazine and benzimidazole and uses those compounds in the manner as contemplated by applicant.

The resulting prior art compounds possess a close structural similarity to the compounds contemplated by applicant and are used in the same manner as contemplated by applicant.

Similar properties may normally be presumed when compounds are very close in structure. Dillon, 919 F.2d at 693, 696, 16 USPQ2d at 1901, 1904. See also In re Grabiak, 769 F.2d 729, 731, 226 USPQ 870, 871 (Fed. Cir. 1985). Additionally, the prior art need not disclose a newly discovered property in order for there to be a prima facie case of obviousness. In re Dillon, 919 F.2d at 697, 16 USPQ2d at 1904-05 (and cases cited therein). If the claimed invention and the structurally similar prior art species share any useful property, that will generally be sufficient to motivate an artisan of ordinary skill to make the claimed species.

Applicant additionally argues that the references due not teach or suggest the exclusion of a hole blocking layer.

The teachings of Okada are broader than the examples. Okada teaches that hole blocking is an optional property of the electron transport layer in paragraph [0230] in the same manner that electron blocking is an optional property of the hole transport layer in paragraph [0227]. Okada further teaches or suggests compounds meeting the limitations of claims 11, 13, 25 and 27.

Applicant also argues that the instant invention yields unexpected results over the prior art. The scope of the showing of the alleged unexpected results is not commensurate in scope with the scope of the claims.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brett A. Crouse whose telephone number is (571)-272-6494. The examiner can normally be reached on Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, D. Lawrence Tarazano can be reached on 571-272-1515. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/B. A. C./ /D. Lawrence Tarazano/

Examiner, Art Unit 1794 Supervisory Patent Examiner, Art Unit 1786